

FINAL REPORT

MODIFICATION OF RICHARDS MODEL 940 VIEWER

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by

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SECTION I

PROGRAM ACCOMPLISHMENTS

PURPOSE

The objective of this program was to replace the standard glass platen on a Richards Model 940 film viewer with an electrostatic panel. The performance of the resulting instrument was then to be evaluated and techniques developed for film handling. A prototype viewer incorporating design ideas was to be delivered to the customer. STAT

BACKGROUND

The standard Richards viewer does not offer a means of maintaining the film in close contact with the viewing platen. The Simco Company, Inc. of Lansdale, Pennsylvania has developed a translucent Lectro-Plaque film holder having an imbedded metal grid which utilizes the principle of electrostatic attraction to hold film tightly against the surface of the panel. Such a panel was used to replace the glass platen of the Richards viewer. A primary consideration during the development of the breadboard model was that any modifications to the original viewer or changes in operating technique should not greatly affect the convenience of using the viewer or the efficiency of the operator. Problems which required solution during the program involved:

1. Methods of making the initial film-platen contact.
2. Methods of negating the holding force of the platen, so that the film may be advanced.
3. Methods of neutralizing the static charge on the film after removal from the platen, so that dust will not collect on the film.
4. Operating procedures which eliminate the annoyance of electrical shock.
5. The availability of an electrostatic panel suitable for viewing 9 inch film.

INITIAL FILM-TO-PLATEN CONTACT

The film is not attracted by the electrostatic platen until it has been smoothed into place by hand or with a conductive metal brush. Another, but less convenient, method of making the initial film-platen contact is by passing a static eliminator bar near the

surface of the film. Experience indicates that a gloved hand provides the most convenient method of establishing the initial film-platen contact.

SEPARATION OF FILM FROM PLATEN

The electrostatic force between the film and the platen remains after the high voltage is removed from the platen grid. No method has been found to release the film from the platen, but rather it is necessary to produce a counteracting force to overcome the electrostatic attraction. In several mechanical arrangements which were tried, the film spool holders were used to pull the film from the platen. These were found to be inconvenient and inefficient to use. The prototype viewer utilizes a burst of compressed gas directed between the film and the platen to overcome the electrostatic forces and cause the film to be released by the platen.

DISCHARGING TECHNIQUES

The film remains partially charged after it has been removed from the platen. This charge must be neutralized, so that the film will not attract dust. The Simco Company, Inc. markets ionized air blowers, static eliminator bars, and electrostatic film cleaners which are adaptable to this situation. The ionized air blower was found to be effective in neutralizing the charge on the film. This device produces a characteristic ozone odor which is annoying, although - according to the manufacturer - the ozone concentration is not high enough to be hazardous. The static eliminator bars also were found to neutralize the charge on film passing close to them, without the disagreeable ozone odor. One of these bars was installed at each end of the prototype viewer, ahead of the film spools. A small blower near each static eliminator bar contributes to the discharging of the film and the elimination of dust on the film. The electrostatic film cleaner probably would provide an even more effective method of discharging the film and eliminating dust. The film cleaner is the only one of the three film discharging techniques which will effectively remove dust already on the film.

OPERATOR PROTECTION

The operator of the modified viewer should be electrically grounded at all times to eliminate the possibility of annoying shocks. These shocks will not be dangerous, as they simply accompany the transfer of any electrostatic charge accumulated by the

operator's body, but they are disagreeable. To prevent the accumulation of charge while using the modified viewer, the operator should stand on a grounding mat which is provided. If the operator is wearing shoes which have insulating soles (rubber, plastic, or crepe), he should also wear the "Solestat" conductive shoe insert provided by the Simco Company. If these precautions are followed, no disagreeable shocks will be noticed by the operator.

PLATEN SIZE

The electrostatic panel installed on the prototype viewer has a 1-1/2 inch opaque border, reducing the viewing area to 8 x 37 inches. The border provides electrical insulation between the wire grid imbedded in the panel and the edge of the panel. The Simco Company stated that a panel with a 3/4-inch border probably could be supplied, thus increasing the viewing area to 9-1/2 x 38-1/2 inches and allowing the full width of 9-inch film to be viewed.

SECTION II

DESCRIPTION AND SPECIFICATIONS OF PROTOTYPE VIEWER

GENERAL

The prototype viewer consists of a Richard Model 940 unit in which the normal glass platen has been replaced by an electrostatic platen. A system for directing a burst of compressed gas between the film and the platen is included to aid in the release of the film from the platen. A static eliminator bar and fan at each end of the viewer aid in removing the electrostatic charge from the film as it is being advanced. Photographs of the prototype viewer and a schematic diagram of the electrical control circuitry are included with this report.

PLATEN

The electrostatic platen is a translucent Lectro-Plaque film holder developed by the Simco Company, Inc. of Lansdale, Pennsylvania. It consists of a translucent panel in which a metal grid has been imbedded. A potential of about 15,000 volts is applied to the grid. Film that has been brought in contact with the platen with the hand or a conductive brush will be electrostatically attracted to the platen. The 15,000 volt potential is provided from a power supply having a very high impedance (several hundred megohms), thus minimizing any danger to the operator.

FILM DISENGAGEMENT

The film is removed from the platen by a short burst of compressed gas directed between the film and the platen along the front and at each end. The compressed gas is supplied by a five pound bottle of carbon dioxide, regulated to a pressure of about 80 psig by a high pressure regulator. A ballast tank having a volume of about 50 cubic inches is kept pressurized by the CO₂ bottle and provides a large volume source of gas at constant pressure for the burst. A low restriction solenoid valve on the outlet of the ballast tank is opened for approximately 0.1 second, allowing about 20 percent of the volume of gas in the ballast tank to escape. Since the change in volume is small, the pressure drop in the ballast tank is only about 15 psig, resulting in a burst of gas at fairly constant pressure. The burst of gas escaping from the ballast tank is piped to

the 1/8-inch tubing around the front and ends of the platen, where it is directed between the film and platen through 0.030-inch diameter holes in the tubing at about 2-1/2 inch intervals.

The operation of the film removal system is electrically controlled by the components in the control box at the left end of the viewer and on the small control panel shown in the photograph. Two pushbutton controls are available on the control panel. Depressing the HOLD pushbutton will turn on the power supply to the electrostatic panel. The static eliminator bars and fans will be off. Depressing the RELEASE pushbutton will turn off the power supply to the electrostatic panel, turn on the static eliminator bars and fans, and allow the short burst of compressed gas to cause the film to be released as described above. The gas burst duration is controlled by an adjustable time-delay relay. The control on the front of the control box may be set to give burst durations from 0.1 to 1.0 second. The 0.1 second burst is obtained with the control in the maximum counterclockwise position.

SECTION III

INSTALLATION OF PROTOTYPE VIEWER

GENERAL

The modified viewer is shipped disassembled and consists of the following units.

- a. Modified viewer assembly, including ballast tank, controls, and fans.
- b. Two film spool holder assemblies.
- c. Two static bars with mounting brackets:
- d. Static bar power supply.
- e. Personnel grounding mat.
- f. Platen power supply.
- g. High pressure gas bottle and regulator.

The high pressure gas bottle is shipped empty. It is recommended that the bottle be filled to a pressure of 800 psig. at room temperature with 5 pounds of carbon dioxide.

ASSEMBLY AND CONNECTIONS

Install and connect items shipped in the disassembled condition - to allow proper packing - and make necessary connections, as described in the following steps.

- a. Attach the film spool holder assemblies to the appropriate ends of the viewer.
- b. Attach a small fan to each rear film spool holder, using the two machine screws supplied with each fan.
- c. Attach a static bar to each end of the viewer. The static bar will be located approximately 1/4 inch above the film rollers and is held in place by the thumbscrews in the mounting blocks below the film spool holder. The power cables for the static bars should be led to the rear of the viewer.
- d. Connect the platen and static bar power cables to their respective power supplies.
- e. Plug the platen and static bar power supplies into the appropriate ac outlets at the rear of control box, located at the left end of the viewer.
- f. Attach the quick-disconnect air line to the high pressure regulator on the gas bottle.
- g. Place the grounding mat on the floor in front of the table on which the viewer

is located.

h. Attach a ground wire from the ground lug on the rear of the platen power supply to earth ground (water pipe, etc.).

i. Attach the grounding mat ground lead to the ground lug on the rear of the platen power supply.

j. Connect a ground wire from the ground lug at the left end of the viewer (near the platen power cable) to the lug on the rear of the platen power supply.

NOTE

To eliminate the possibility of annoying electrical shocks, the operator should wear the conductive shoe insert provided and stand on the grounding mat when using the viewer.

SECTION IV

OPERATION OF PROTOTYPE VIEWER

The proper procedure for operation of the modified viewer is described in the following steps.

- a. Load the reel of film to be viewed, positioning the spool holders so that the film is near the front edge of the illuminated area of the platen. The viewer lamp is controlled in the normal manner.
- b. Open the valve on the gas bottle completely and adjust the pressure regulating screw on the front of the pressure regulator in a clockwise direction until a pressure of approximately 80 psi. is indicated on the gauge.
- c. Plug the power cord from the control box at the left end of the viewer into a 110 Vac outlet. The fans and static bars will now be ON.
- d. Set the power switch on the platen power supply to LOCAL.
- e. When a section of film is found that is to be viewed, depress the HOLD button on the control panel. The platen power supply will be turned on, and the fans and static bars will be turned off.
- f. Smooth the film onto the platen with the hand. The film will be electrostatically held by the platen.
- g. Press the RELEASE button to release the film so that it can be moved.

NOTE

Depressing the RELEASE button will open a solenoid valve for a controlled length of time. The resulting burst of gas will cause the film to be released. Also, the static bar and fans will be turned on.

- h. The burst duration may be varied from 0.1 second to 1.0 second to accommodate various films and viewing conditions by rotating the control on the control box at the left end of the viewer clockwise. Pressure may be altered by the screw on the gas bottle regulator. Normally, a burst duration of 0.1 second (maximum counter-clockwise control position) at 80-90 psi. will cause the film to be released.
- i. To discontinue operation, shut off the valve on the gas bottle, and disconnect the control box power cord from the ac power line.

SECTION V

PROGRAM CONCLUSIONS

1. The electrostatic platen offers a method of holding the film flat against the viewing platen while maintaining uniform illumination.

2. The level of film illumination on the prototype viewer is approximately one third that of the conventional viewer. The level of illumination is sufficient, however, for the proper viewing of most films.

3. Short strips of film having a tendency to curl and whose ends are not held by film spools are not held satisfactorily by the electrostatic platen. Single frames are adequately held.

4. The static eliminator bars discharge the film; but, even with the fans, they do not remove dust already on the film when it was charged.

5. The compressed gas burst provides a satisfactory method of separating film from the platen. A five pound carbon dioxide bottle charged to 800 psig. at room temperature will provide over 1600 bursts, where each burst lasts 0.1 second at a pressure of 80 psig.

6. A slight reverse tension on one of the film spool holders will aid considerably in removal of the film from the platen and allow a reduction in the operating gas pressure to about 70 psig.

7. The cost of the modification, similar to that performed on the prototype viewer, would be approximately each in production quantities. The possibility exists for operating two modified viewers from one set of platen and static bar power supplies. If this is done, the price per unit would be reduced to about but the operator would no longer be able to control the charging power to each platen and each set of static bars independently.

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SECTION VI

RECOMMENDATIONS

The following recommendations are presented as a result of experience with the prototype viewer.

1. The electrostatic platen used in the prototype viewer was not of precisely the right dimensions to directly replace the original platen. A new front mounting plate was fabricated for the viewer to accommodate the oversize platen. Production units should have a platen of the same size as the original to simplify the replacement.

2. The high voltage cable connected to the platen should be brought out of the platen at a rear corner, rather than along the end where it interferes with the film rollers.

3. A constant laminar flow of air across the platen from front to rear would help to keep dust from settling on the platen and would also aid in film separation. It was determined that a flow of about 2-1/2 cubic feet per minute at 10 psig. would be required. It could be directed through the length of tubing along the front of the viewer now used for the gas burst.

4. Instead of the carbon dioxide bottle as a source of compressed gas, an air compressor with a pressure capability of at least 85 psig. could be used. Also other compressed gases, appropriately regulated, could be used. If an air compressor is used, the air which it delivers must be well filtered and dried.

5. An integral air compressor could be provided for use with each viewer for an additional cost of approximately

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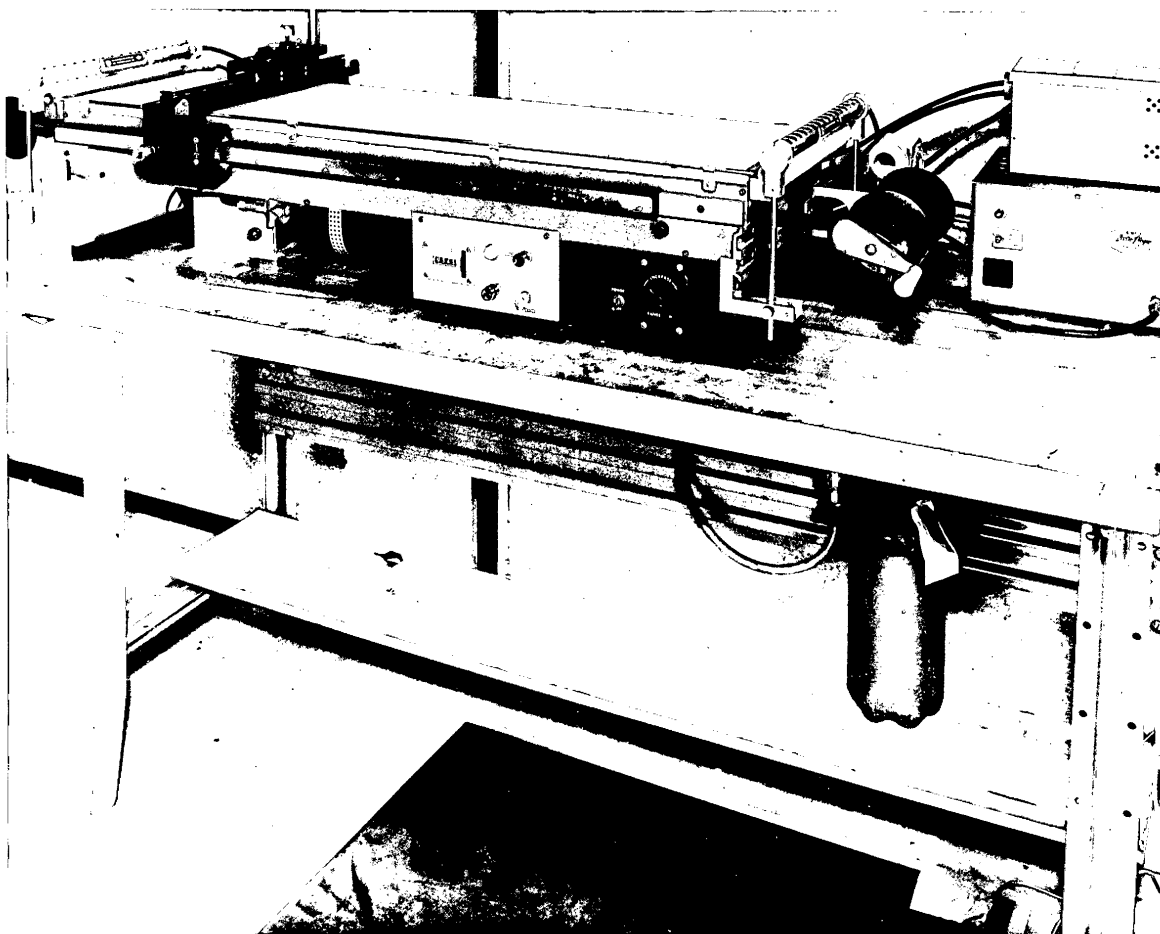
6. An electrostatic film cleaning unit would remove dust more satisfactorily than the static bar-and-fan combination used on the prototype viewer.

7. A master switch should be included on the control panel to enable the operator to remove all electrical power from the system without disconnecting the power cord.



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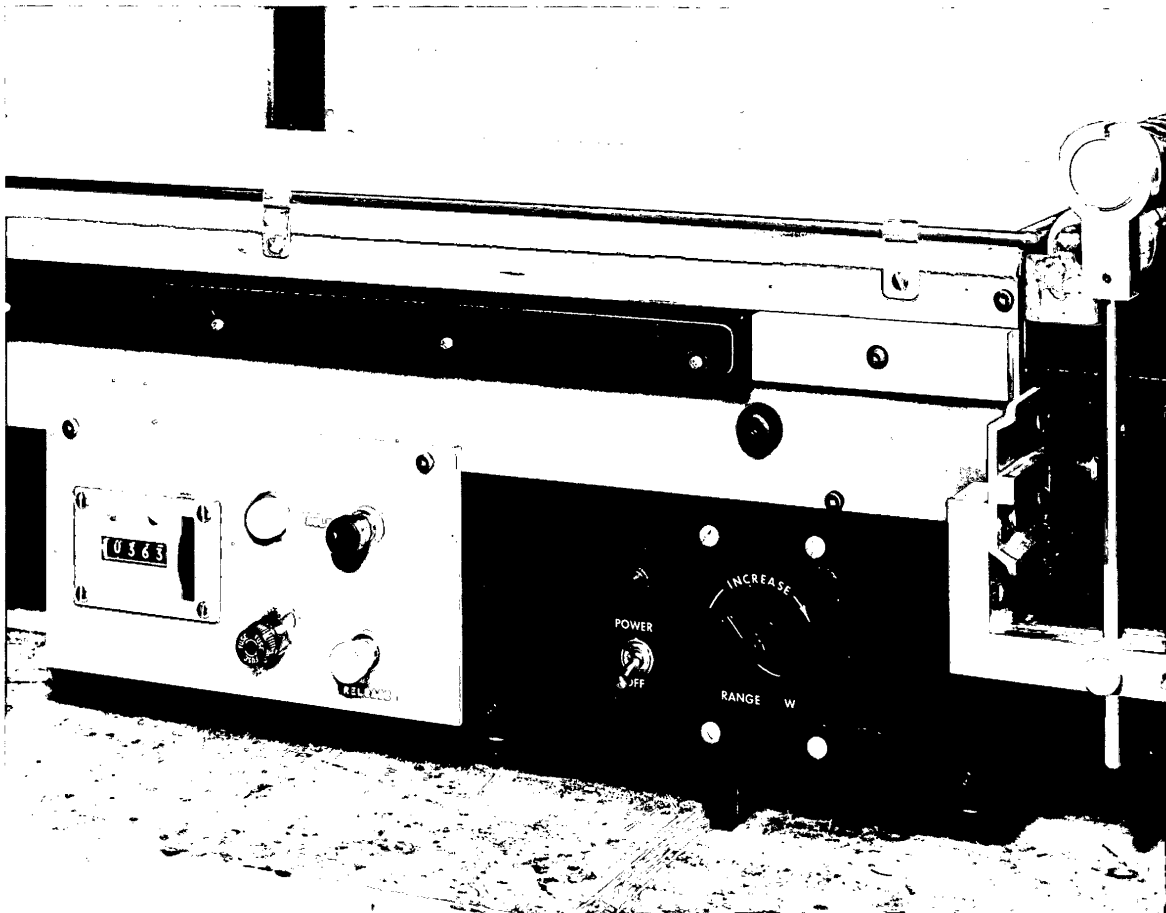
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Modified Richards Viewer (Front View)

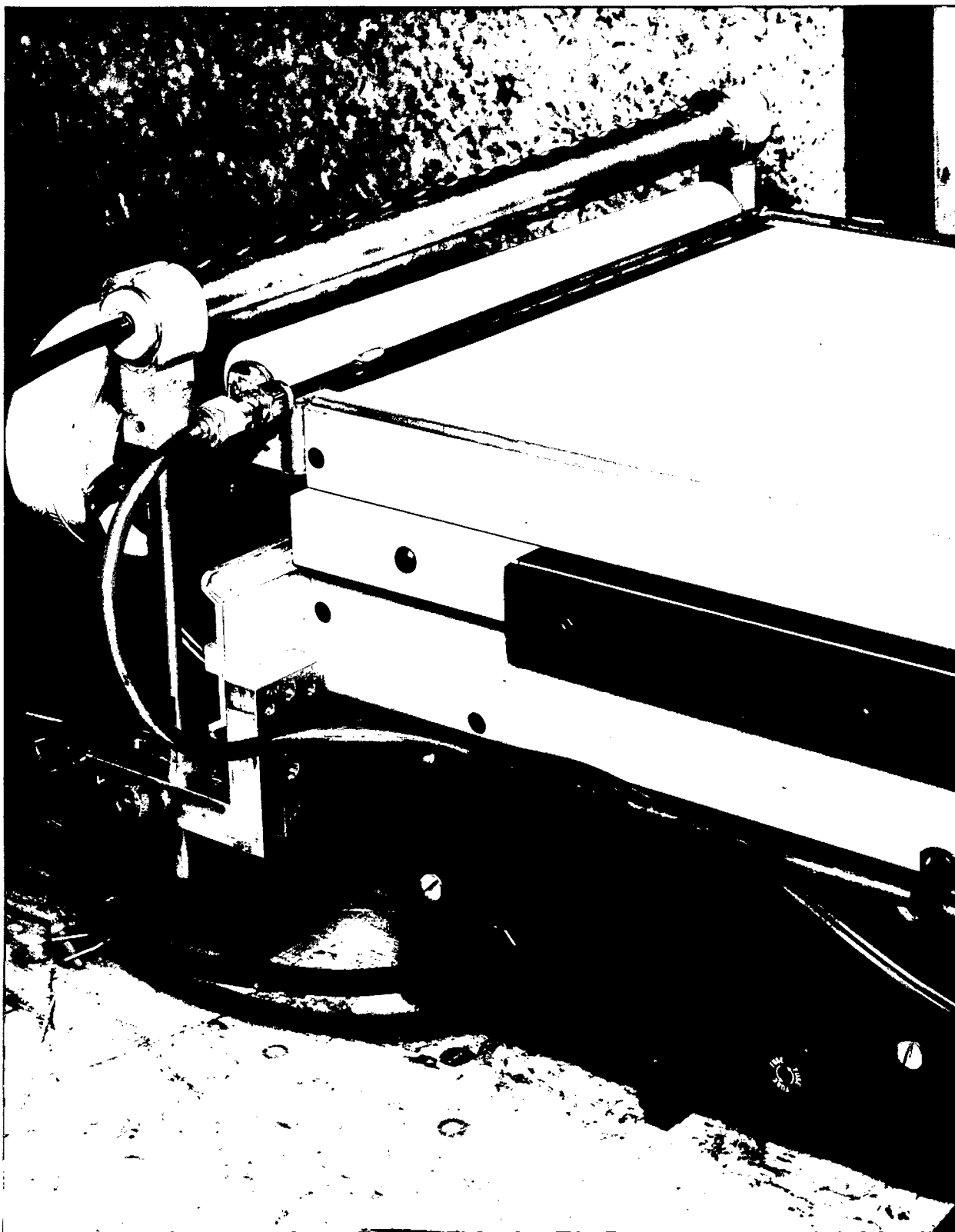
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Control Panel

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Static Bar and Fan Assembly (Rear View)

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